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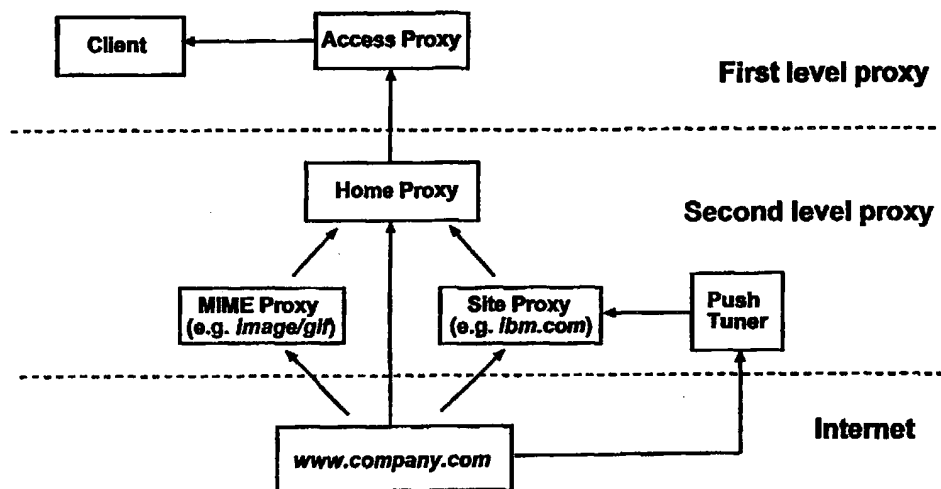
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(54) Title: PROCEDURE TO BUFFER INFORMATION IN A COMMUNICATIONS SYSTEM



(57) Abstract

Procedure and communications system to buffer information in a communications system, with a system design which is in accordance with, or is similar to, WWW (World Wide Web), at which a proxy server buffers information or files for further distribution to user 1, at which the information is buffered in a structured way on several levels, at which access time is reduced and that double storing of information is avoided. Communications system including computer equipment located at a user's 1, which communicates via his/her computer by an open computer network, and intends to collect information from one or more computers which are connected to the open computer network, at which the information which is collected to the own computer first is buffered in a special computer, or server, at which the buffering is done in a number of in the communications network existing servers, or computers, depending on the type of information which is collected from the open computer network.

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TITLE OF THE INVENTION: PROCEDURE TO BUFFER INFORMATION IN
A COMMUNICATIONS SYSTEM

TECHNICAL FIELD

5 Procedure to buffer information in a communications system,
with a system design which corresponds to, or is similar
to, WWW (World Wide Web), at which a proxy server buffers
information or files.

10 PRIOR ART

World Wide Web (WWW) operates with client-server
technology. This means that the user apparently operates in
his/her own computer all the time, though he/she collects
information from sources on the network.

15 The client-server communications in WW is "state-less",
which means that client and server does not maintain a
communication link between the transactions - a connection
is established over again each time. In spite of that the
client program is running continuously, the client and the
20 server only are in contact with each other during the time
it will take to deliver a document between them.

A WWW-service consists of a collection of hypertext
documents which are linked to each other, and a program
which can transmit these to the clients. The service can be
25 compared to a catalogue or a newspaper, but with built-in
links to other information sources. But unlike a printed
catalogue, a WWW-service also can be interactive - it can
offer possibilities to search information, transmit
messages and to order material directly over the network.

30

The protocol which is used when the WWW-document is
executed over the network is called HTTP - Hypertext
Transfer Protocol.

The server program which handles the document distribution
35 is called httpd - the HTTP-demon, in UNIX language. The
program httpd is continuously listening for HTTP-calls from

the network, ready to deliver documents to clients. When it receives a request for a document, it checks that the request is legitimate, that the file exists, and then the document is transmitted to the client's IP-number.

5

The functions of the WWW-server can be summarized according to the following and is shown in overview in Figure 1:

- 10 • Collect and return HTML-documents to client programs.
- Translate URLs to the server's file system (mapping).
- Transmit information about the type of the files, date and size according to MIME (typing).
- 15 • Generate and transmit graphic file catalogues with README-files.
- Transmit users HTML-pages via /~user name/.
- Redirect HTTP-requests to other WW-servers (redirection).
- 20 • Keep a log file with data about which computers that have requested respective document.
- Start external programs to collect data and generate dynamic documents.
- Include external files in HTML-documents (server side includes, only NCSA).
- 25 • Act as proxy server and buffer files.

TECHNICAL PROBLEM

A WWW-server which operates as a so called proxy server
30 normally receives HTTP-calls from clients in a local network, and forwards them to the external end destination. When the documents then are delivered from the network, the proxy server receives the document, buffers it in its cache, and finally transmits it to the client program. This
35 will be done for all HTTP-calls for the client programs which have set up the server as their proxy server.

A proxy server is usually run in a so called fire wall computer which constitutes a barrier between a local network and Internet. The buffering of documents in the cache memory of the server will have the good effect that a lot of documents can be collected directly from the cache of the server, without the need of loading the network. However, this method of storing is not very well thought-out and efficient, because the system only to a limited extent is adapted to simple terminals and lower bandwidths, as, for instance, at transmission of information via modem or ISDN.

TECHNICAL SOLUTION

The technical solution is described in what is indicated in the patent claims.

ADVANTAGES

By the present invention the communication between a user and the open data network Internet is improved, especially when the transmission is performed on smaller bandwidths as for instance at use of modem or ISDN.

By dividing the web pages into their components (i.e. text, pictures, audio and video) which then are stored in different proxy servers in the system, a better use of available storing space than with the proxy systems of today with only one level (corresponding to Access Proxy), is achieved.

DESCRIPTION OF FIGURES

Figure 1 illustrates the principle of a known solution for WWW.

Figure 2 illustrates a part of a network architecture according to the invention.

DETAILED DESCRIPTION

In order to facilitate the understanding of the present invention, an explanation of used abbreviations is presented below.

5

HTML HyperText Markup Language. The "language" which is used and which Netscape interpretes, when a web page is made, for layout and links. Almost all addresses to web pages end in ".html". If one

10 wants to see what the HTML-code looks like, one opens a web page and selects "View Source" or "Document Source" under the "View"-menu in Netscape, and the code will turn up. All within "<" and ">" are HTML-codes.

15

HTTP HyperText Transfer Protocol. A transfer protocol which is used when two computers transmit hypertext documents (document.html) between themselves.

20

IP Internet Protocol. One of the protocols on which Internet is based.

IP-address, IP-number

25

A numerical address to a computer on an IP-network (for instance Internet). IP-addresses has the form of nnn.nnn.nnn.nnn, i.e. four groups of one to three integers, separated by points.

30

Gif;Gif Graphical Interchange Format. A picture format, or rather a method of compressing pictures.

Java

35

A programming language which is used to increase the interactivity of a web page. In practice it will work in such a way that when the user "enters" a page with Java, the small program is

loaded over to his/her computer, and is executed by the browser, i.e. is run by Netscape.

- 5 **MIME** Multipurpose Internet Mail Extension. A standard for i.a. transmission of appendices to e-mail. MIME also makes it possible to transmit Swedish/national characters (å,ä,ö) in an e-mail without having them distorted.
- 10 **WWW** "The World Wide Web". The server system on the Internet which contains information and services which are linked together by means of hypertext documents.
- 15 The invention is based on use of proxy servers in a number of levels, where information is buffered in a structured way, making the access time reduced, at the same time as double storing of information is avoided.
- 20 Figure 2 illustrates a network architecture for efficient buffering in World Wide Web according to the invention. In the Figure is shown diagrammatically division of the buffering in different proxy levels and the denomination of the different buffering places (proxies) where buffering is
- 25 done and which are described in the following.

The invention is described for an embodiment where up to three proxy-steps exist between client and original web server. If a user which intends to use Internet makes use

30 of a limited number of terminals (computers), Access Proxy and Home Proxy will in most cases be the same server.

The procedure to buffer information is based on that the user authenticates himself/herself to be offered advanced

35 and for the person adapted services.

On the first level, authentication of the user and set up to respective home proxy is done. This is done by the functionality which exists in an Access Proxy. This is done either integrated with the authentication of the IP-network
5 (for instance in modem pool) or via separate JAVA-mechanism in Access Proxy. When a user has authenticated himself/herself via logging in, he/she can use all services and resources which he /she has authorisation for. This is guaranteed by the proxy servers utilising a common data
10 base for information about users and in-loggings.

The proxy-functions of the second level guarantees a quality of service (QoS) which is adapted to the user's system by reducing file sizes to the user's available
15 bandwidth and hardware.

By distributing the files on different servers in a structured way, by the functionality which exists in home proxy, double storing is avoided. To the second level Home Proxy, Mime Proxy, Site Proxy and Push Tuner are referred.
20 Home Proxy is placed in a physical server which the system has identified as optimal to a certain user. A user who normally connects from the same geographical place will, by the system, be allocated the nearest server for Home Proxy. If a user changes his/her access-pattern (for instance at
25 travelling or permanent removal), the system will, after a certain time, change the allocation of Home Proxy for this user. At most accesses Home Proxy therefore will be the same server as Access Proxy.

By all users always using the same Home Proxy, the cache of
30 this server often will contain requested web-material, i.e. "hit rate" for the cache function in Home Proxy will be high.

Home Proxy selects for each HTTP-access whether the material shall be collected directly from the original web
35 server, or if it shall be collected via the specialised MIME Proxy or Site Proxy. By that, Home Proxy controls the

second proxy-level. In the same way appointed Site Proxy gives a mechanism to, in an efficient way, store information which belongs to popular information suppliers, without the users needing to select between so called
5 "mirror sites".

In order further to save bandwidth, Home Proxy has functionality to compress information if it knows that the terminal manages decompression. In a similar way Home Proxy attends to unpacking of compressed information of formats
10 which the terminal does not know.

Certain web-material need to be adapted to different bandwidths, different types of terminals, or according to the wishes of the user. Example of this is graphic material
15 (for instance the MIME-types *image/gif* and *image/jpeg*), the bandwidth need of which is heavily reduced by reducing the resolution concerning colour and pixels. In the same way presentation elements as, for instance, video, are adapted to otherwise insufficient bandwidths and terminals.
20 By the MIME Proxy being specialised to manage specific MIME-types, it will be equipped with special software or hardware to adapt just this type of information without larger delays arising. Scalability for these MIME-types is an important part to offer adapted Quality of Service
25 (QoS).

In the system, all Home Proxies know which MIME Proxies that manage respective MIME-type.
Certain sites in World Wide Web are more popular than others. By certain proxy servers being responsible for
30 buffering information from a certain name domain (for instance *ibm.com*) which is not handled by MIME Proxy, for instance software or text, better storing efficiency is achieved than if all proxy servers buffer this information. A Home Proxy knows which Site Proxies that handles
35 different name domains. By the system knowing which proxy server/servers that caches information from a certain name

domain, it will be possible to make programmed updating of the material by means of so called PUSH-technology.

The third level is the public Internet. This level is used
5 if the wanted information does not exist in the system, or
if an updating has been made on the original web server.
Owners of popular web-sites can offer information channels
by which updatings are transmitted regularly (a number of
times per twenty-four hours). In that way is avoided that
10 all readers must go to the original web server to get the
most updated information. A so called Push Tuner is used to
refill a Site Proxy with updated information.

The invention is limited only to what is indicated in the
15 patent claims, so the idea of the invention is applicable
to all types of buffering procedures which have their
realisation in a communications network.

PATENT CLAIMS

1. Procedure to buffer information in a communications system, with a system design which is in accordance with, or is similar to, WWW (World Wide Web), at which a proxy server buffers information or files for further distribution to users (1),
c h a r a c t e r i s e d in that the information is buffered in a structured way on several levels, at which access time is reduced and double storing of information is avoided.
2. Procedure as claimed in patent claim 1,
c h a r a c t e r i s e d in that the buffering is done on 3 levels, at which the first level handles authentication of users and set up to intended home proxy, and the second level includes proxy functions which guarantee a QoS which is adapted to the user's system by reducing the information to the user's available bandwidth and hardware, at which the third level is the public Internet.
3. Procedure as claimed in patent claim 2,
c h a r a c t e r i s e d in that home proxy distributes the files or the information on different servers.
4. Procedure as claimed in patent claim 2,
c h a r a c t e r i s e d in that the information consists of web pages which are divided into their components, i.e. text, picture, audio and video.
5. Procedure as claimed in patent claim 3,
c h a r a c t e r i s e d in that the different components are stored in different proxy servers in the system.

6. Communications system including computer equipment located at a user's (1) who communicates via his/her computer with an open computer network and intends to collect information from one or more computers which are connected to the open computer network, at which the information which is collected to the own computer first is buffered in a special computer, or server, characterised in that the buffering is done in a number of in the communications network located servers, or computers, depending on the type of information that is collected from the open computer network.
7. Communications system as claimed in patent claim 6, characterised in that the information which is collected from the open computer network consists of web pages which are stored at different buffering places, or proxy servers, depending on which type of information the web pages represent.
8. Communications system as claimed in patent claim 7, characterised in that the information of the web pages consist of the different components text, picture, audio and video.
9. Communications system as claimed in patent claim 6, characterised in that the servers for buffering are located on three levels, where the user only has direct contact with a first buffering server on a first level, and the server which delivers information to the user located on a third level has direct contact with all servers on a second level among the buffering servers.

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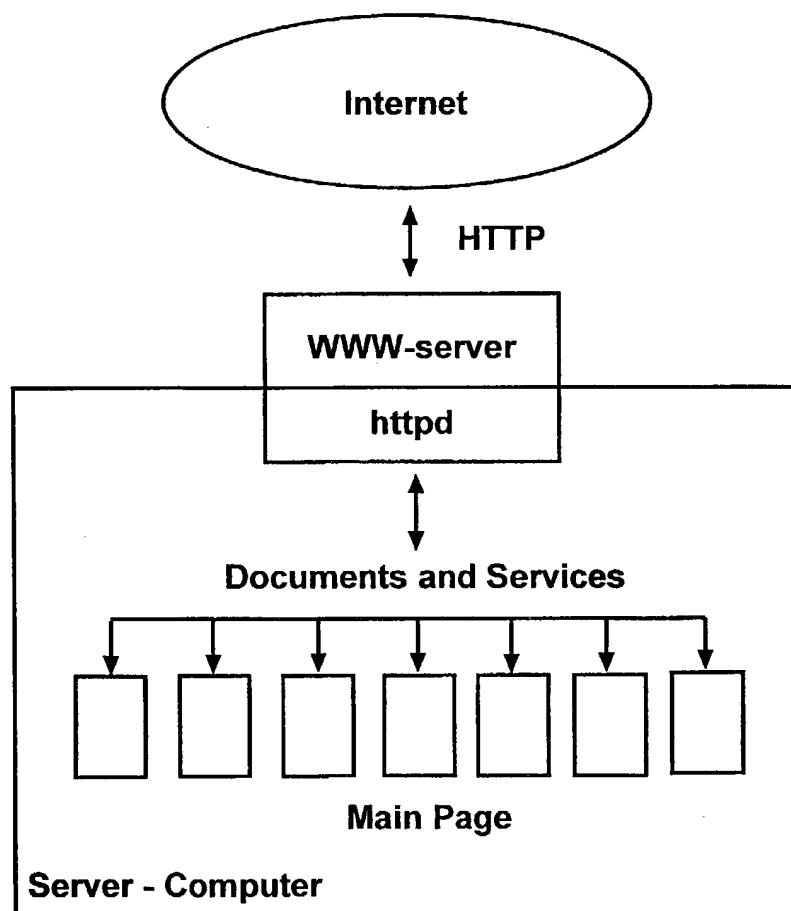


Figure 1

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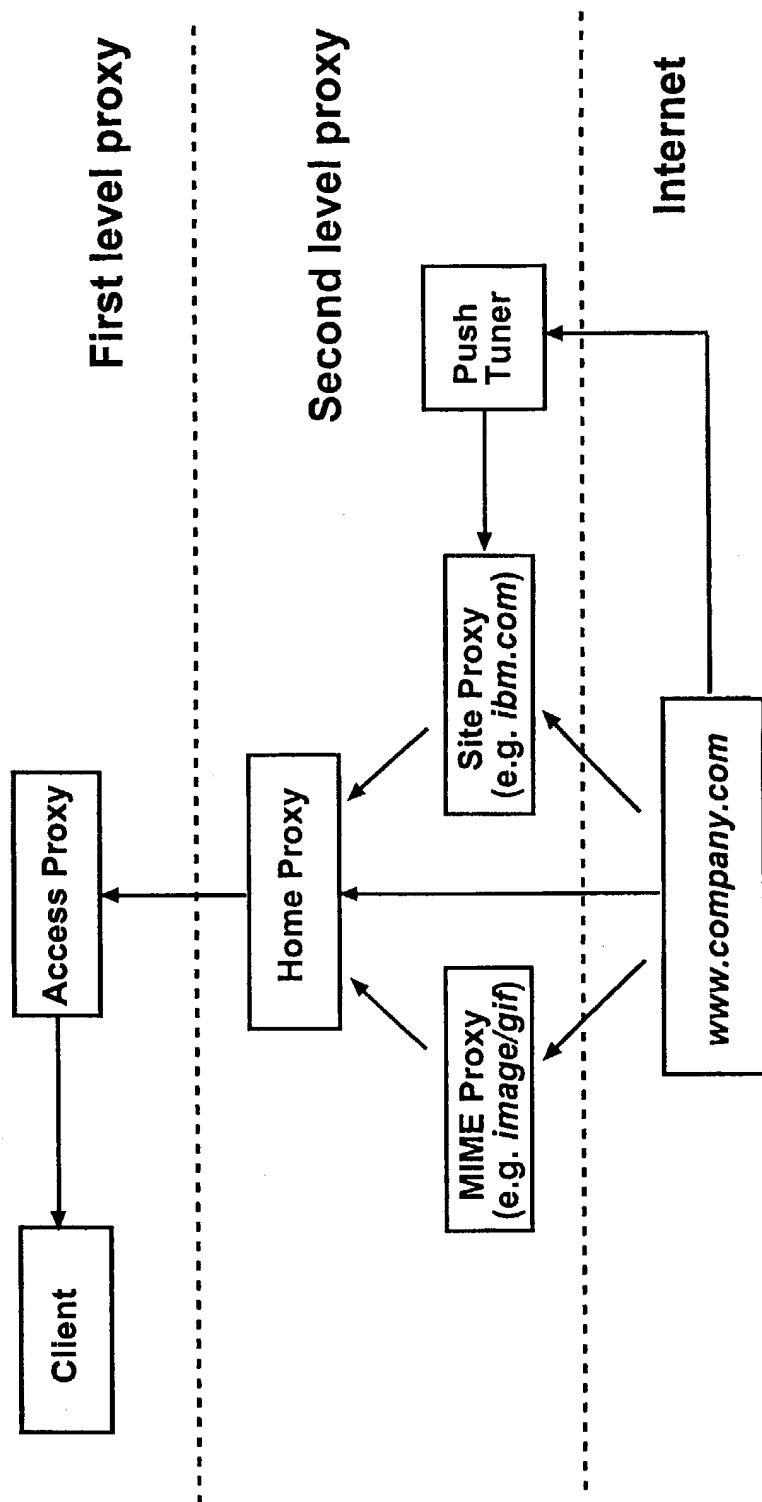


Figure 2

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 99/00058

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: G06F 17/30

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

DIALOG, PAJ, TDB, WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0811939 A2 (WEBTV NETWORKS INC.), 10 December 1997 (10.12.97), column 1, line 15 - column 2, line 30; column 13, line 45 - column 19, line 20, figure 1, claims 1-3, 20-23, abstract	1-5
A	--	6-9
P,A	WO 9905584 A2 (MIRROR IMAGE INTERNET AB), 4 February 1999 (04.02.99), page 1 - page 8, claims 1-10, abstract	1-5
P,X	--	6-9

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☒ See patent family annex.

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Date of the actual completion of the international search

11 June 1999

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 99/00058

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 9738389 A2 (LEXTRON SYSTEMS, INC.), 16 October 1997 (16.10.97), page 3 - page 5, claim 1, abstract --	1-9
A	EP 0762297 A2 (SUN MICROSYSTEMS, INC.), 12 March 1997 (12.03.97), page 1 - page 2, claim 1, abstract --	1-9
A	World-Wide Web Proxies Ari Luotonen, CERN Kevin Altis, Intel April 1994 See whole document -- -----	1-9

INTERNATIONAL SEARCH REPORT
Information on patent family members

03/05/99

International application No.
PCT/SE 99/00058

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0811939 A2	10/12/97	AU 3375197 A JP 10228437 A WO 9746943 A	05/01/98 25/08/98 11/12/97
WO 9905584 A2	04/02/99	AU 8363998 A SE 510048 C SE 9702795 A	16/02/99 12/04/99 25/01/99
WO 9738389 A2	16/10/97	EP 0892947 A US 5727159 A	27/01/99 10/03/98
EP 0762297 A2	12/03/97	JP 10027143 A US 5826025 A	27/01/98 20/10/98